Relations and Functions

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SET

It is a well defined collection of objects.

Collection of vowel.

$A = \{a, e, i, o, u\}$

Roster form

$A = \{a, e, i, o, u\}$

Set Builder form.

$A = \{x : x \text{ is a vowel}\}$

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ORDERED PAIR

Ordered pair is a collection of elements that are separated by comma and written in parenthesis.

(a, b)

a — First element

b — Second element

If $(a, c) = (d, m)$

$a = d$

$c = m$

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Questions-1

If (x+2,3y+4) = (25,2) then x and y are

$(x+2, 3y+4) = (25, 2)$

$x+2 = 25$

$x = 25-2$

$\boxed{x = 23}$

$3y+4 = 2$

$3y = 2-4$

$\boxed{y = \frac{-2}{3}}$

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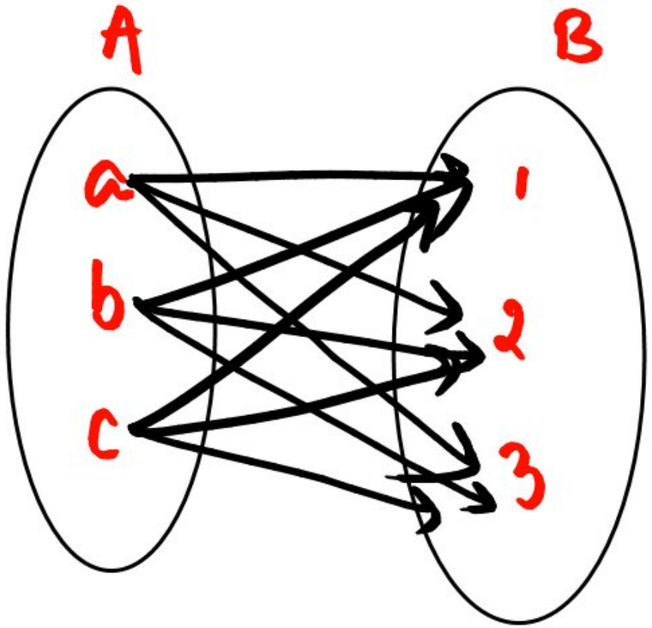
Cartesian Product

If A and B are two non-empty sets , then cartesian product of A and B is denoted by $A \times B$

$$A \times B = \{(a,b);\ a \in A \ \& \ b \in B\}$$



$$A \times B = \{(a,1),(a,2),(a,3),(b,1),(b,2),(b,3),(c,1),(c,2),(c,3)\}$$

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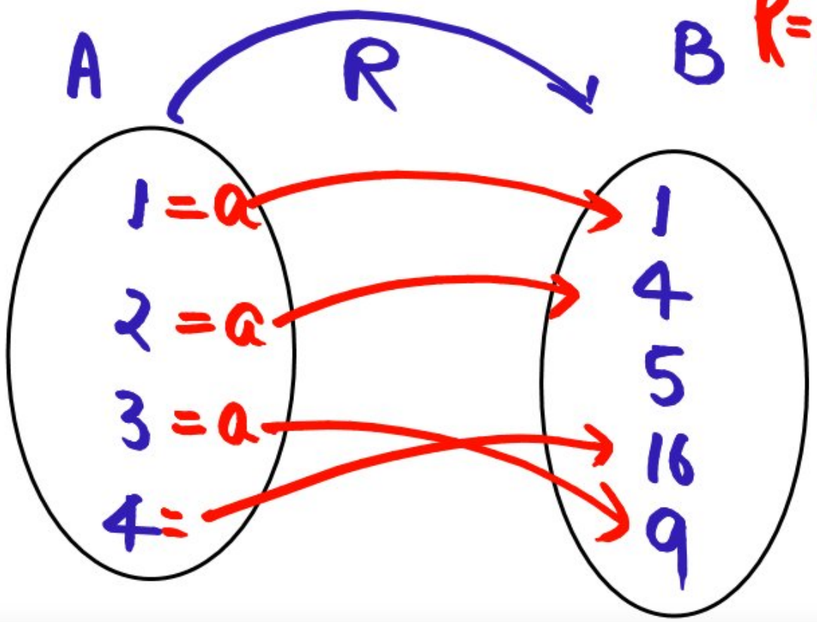
Relations

A relation R from non-empty set A to non-empty set B is the subset of cartesian product of A and B.

The subset is derived by describing a relationship between the first and second elements of ordered pairs.

$$R = \{(a,b) : b = a^2 \ a \in A \ \& \ b \in B\}$$

$$R = \{(1,1)\ (2,4)\ (3,9)\ (4,16)\}$$



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Questions-2

The relation R on the set A = {1,2,3,4, … , 14} defined as

$R = \{(x, y): x, y \in A, 3x - y = 0\}$

$3x - y = 0$

$y = 3x$

$x = 5$

$y = 3 \times 5 = 15$

$R = \{(1,3), (2,6), (3,9), (4,12)\}$

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Domain of Relation

The Set of all the first elements in a relation R from a set A to set B is called Domain of the relation R.

$R=\{(1,3)\ (2,6)\ (3,9)\ (4,12)\}$

Domain of the Relation $=\{1,2,3,4\}$

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Questions-2

If R=$\{(x, y): x, y \in Z, x^2 + y^2 \leq 4\}$ is a relation is set Z then domain of R is

$$x^2 + y^2 \leq 4$$

$$R = \{(0,0)\ (1,0)\ (0,1)\ (1,1), (-1,-1), (-1,1)\ (1,-1)\}$$

Domain of Relation = $\{0, 1, 0, 1, -1, -1, 1\}$

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Codomain and Range of Relation

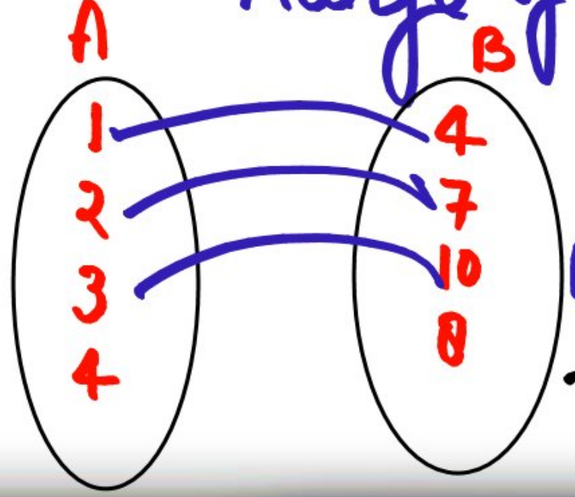
The set of all the second elements in a relation R from a set A to Set B is called the range of the relation R.

The whole set B is called codomain of the relation R.

Range is the subset of codomain.

$R = \{(a,b)(c,d)(e,f)\}$

Range of Relation $= \{b, d, f\}$



$R = \{(x,y) : y = 3x+1,\ x \in A \text{ & } y \in B\}$

$R = \{(1,4)(2,7)(3,10)\}$

Domain $= \{1,2,3\}$ Range $= \{4,7,10\}$

Co-domain $= \{4,7,10,8\}$

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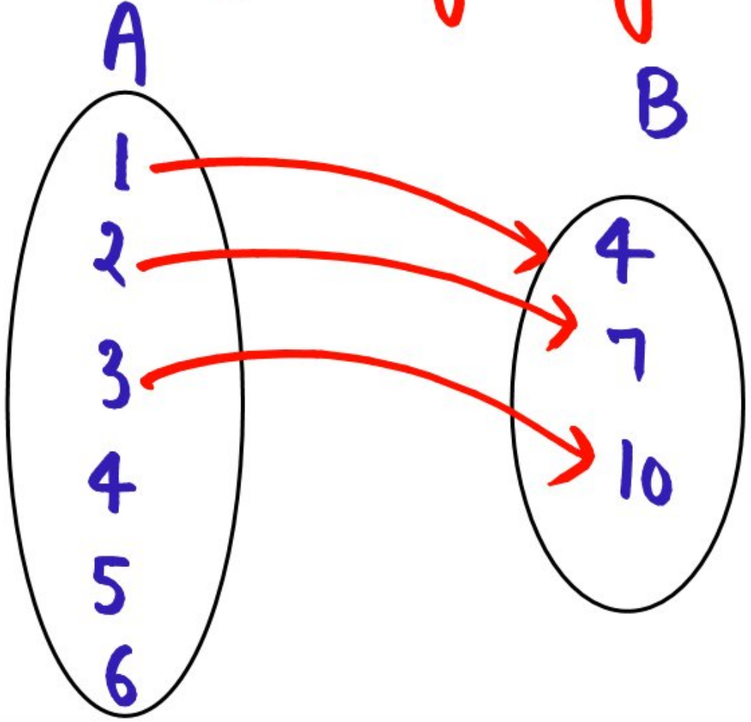
Questions-2

Let A ={1,2,3,4,5,6} & B= {4,7,10} . Define a relation R from A to B by
R={$(x, y): y = 3x + 1, where\ x \in A\ \&\ y \in B$}.
Write down the domain,codomain & Range

$R = \{(x,y) : y = 3x+1 \text{ Where } x \in A \text{ & } y \in B\}$



$R = \{(1,4)(2,7)(3,10)\}$

Domain = {1,2,3}

Co-domain = {4,7,10}

Range = {4,7,10}

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No of Relations

Let A & B be two sets having m &n elements respectively then no possible relations from set A to set B is 2^{mn}.

$n(A) = m \quad n(B) = n$

No of possible relations $= 2^{m \times n}$

Q-1 If $n(A) = 2 \quad n(B) = 7$

Q-2 No of possible relation $= 2^{2 \times 7} = 2^{14}$

$A = \{2,3,4\} = 3 \quad B = \{7,8,9,10\} = 4$

A and B possible No of Relation $= 2^{m \times n} = 2^{3 \times 4} = 2^{12}$

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If A is the set of even natural numbers less than 12 and B is the set of prime numbers less than 17 , then the number of relations from A to B is

$A = \{2, 4, 6, 8, 10\}$

$n(A) = 5$

$B = \{2, 3, 5, 7, 11, 13\}$

$n(B) = 6$

No of Possible Relation $= 2^{m \times n} = 2^{5 \times 6} = 2^{30}$ Ans

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Inverse Relation

Let R be a relation from A to B then R^{-1} From B to A is defined as the inverse of R i.e
$R^{-1} = \{(y, x): (x, y) \in R\} \subseteq B \times A$

$R = \{(a,b)(c,d)\}$

$R^{-1} = \{(b,a)(d,c)\}$

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Questions-2

A = B =

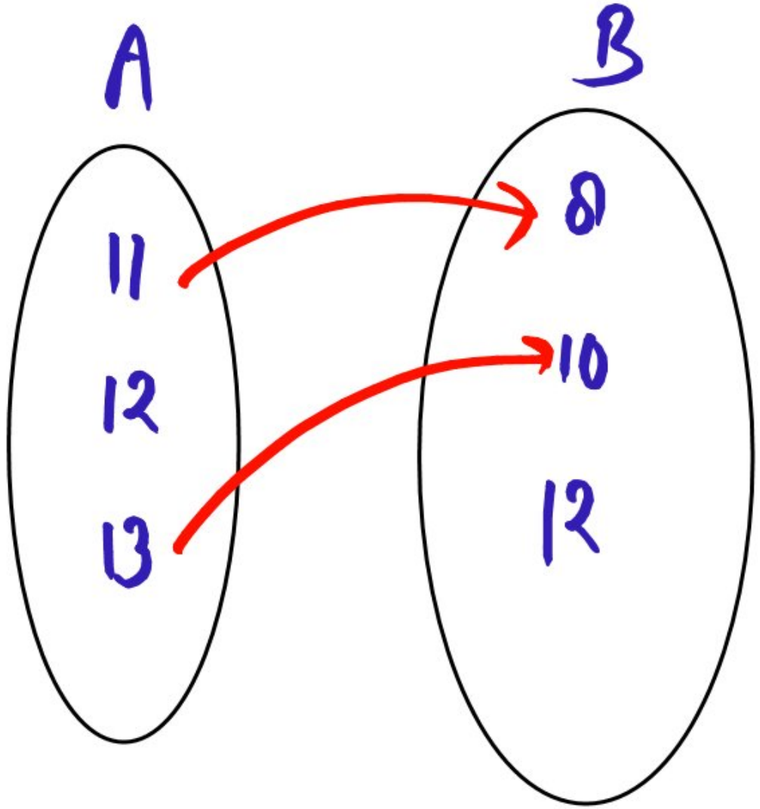
If R is relation from $\{11,12,13\}$ *to* $\{8,10,12\}$ defined by y=x-3 then R^{-1} *is*

$A = \{11, 12, 13\}$ $B = \{8, 10, 12\}$

$y = x - 3$

$R = \{(11, 8)\ (13, 10)\}$

$R^{-1} = \{(8, 11)(10, 13)\}$



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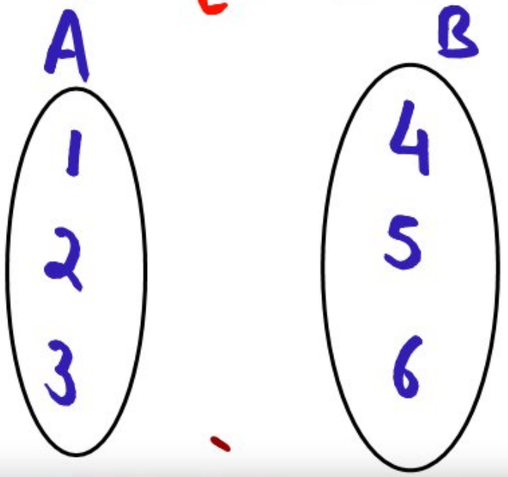
Types of Relations on a Set

1.Null or Empty or void Relation:- Let A be a non-empty set. The empty set ϕ is a subset of $A \times A$, this Relation in A is called void.

$A = \{\} = \phi$

$A = \{1, 2, 3\}$ $B = \{4, 5, 6\}$

$R = \{(a, b) : a > b \quad a \in A \ \& \ b \in B\}$



$R = \{\} = \phi$

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